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(54) Portable electronic device supporting multiple communication protocols

Tragbare, elektronische Vorrichtung mit mehreren Übertragungsprotokollen

Dispositif électronique portatif à protocoles de communication multiples

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- **PATENT ABSTRACTS OF JAPAN vol. 13, no. 64 (P-827) 14 February 1989 & JP-A-63 250 726**
- **PATENT ABSTRACTS OF JAPAN vol. 11, no. 351 (E-557) 17 November 1987 & JP-A-62 130 040**
- **ISO/IEC 7816-3: 1989 (E) "Identification cards - Integrated circuit(s) cards with contacts"**

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Description

[0001] The present invention relates to a portable electronic device such as an IC card having a function of supporting two or more communication protocols.

[0002] An IC card is available as a conventional portable recording medium. This IC card comprises a ROM for storing control programs, a data memory for storing various types of data, a CPU for performing various control operations on the basis of the control programs stored in the ROM, and contacts brought into electrical contact with an external device to exchange data therewith. A communication protocol for performing data communication with the external device is stored in the ROM.

[0003] In recent years, IC cards are used in a variety of applications. The IC cards must exchange data with various external devices such as bank terminals and credit terminals at different positions. For this reason, a plurality of communication protocols are prepared in advance, and a desired communication protocol is appropriately selected. Demand has arisen for an IC card capable of accurately performing communication with external devices having different types of communication protocols.

[0004] In a system including this IC card and external devices, a desired communication protocol used at the time of data communication in the system must be selected and designated at the start time of the system. In any case, even a frequently used communication protocol cannot be used without performing predetermined procedures for designating the communication protocol.

[0005] As described above, in a conventional portable electronic device compatible with a plurality of protocols, a user must designate a communication protocol prior to data communication. Data communication cannot therefore be started at the start time of the system, which is inconvenient. PATENT ABSTRACTS OF JAPAN, Vol. 11, No. 351 (E-557) 17/11/87 & JP-A- 62 130 040 disclose a portable electronic device connectable to an external device, comprising means for communicating with the external device by means of a predetermined protocol, and first storing means for storing software programs. According to this publication, a communication protocol control program used for communication is stored in a ROM built in an IC card to apply the communication control. When starting a communication with a different protocol, a proper protocol is selected from an IC card incorporating the ROM and IC cards are replaced accordingly to start the communication.

[0006] PATENT ABSTRACTS OF JAPAN, Vol. 11, No. 64 (P-827) 14/2/89 & JP-A- 63 250 726 disclose a reader/writer terminal to be used with different IC cards. When a IC card is supplied to the terminal, information specifying the protocol of the IC card is received therefrom and is processed by the terminal which then selects an appropriate format conversion table and parameter setting table.

[0007] ISO/IEC 7816-3 : 1989(E) "Identification cards - Integrated circuit(s) cards with contacts" discloses a portable electronic device in form of an IC card which can communicate with an external device using one of a plurality of communication protocols which the IC card supports, wherein the IC card is adapted to transmit an information on the supported protocols in Answer-to-Request data and uses the protocol selected by a protocol-type selection command transmitted from the external device, or, if no protocol-type selection command is transmitted, uses a predetermined default protocol if this default protocol is supported by the IC card.

[0008] It is an object of the present invention to provide a portable electronic device compatible with a plurality of protocols and capable of starting data communication at the start time of a system.

[0009] This object is solved by the features mentioned in claim 1.

[0010] Furthermore, an IC card system is provided in accordance with claim 6.

[0011] The portable electronic device may further comprise priority order setting means for setting a priority order for the different types of communication protocols stored in the storing means, means for selecting a predetermined communication protocol from the different types of communication protocols on the basis of the priority order set by the priority order setting means, and communicating means for performing communication using the predetermined communication protocol selected by the selecting means.

[0012] A priority order is preset for the plurality of communication protocols stored in the storing means of the electronic portable device. At the start time of a system, a communication protocol having the highest priority is automatically selected. Consequently, when the communication protocol having the highest priority is used, data communication can be started simultaneously with the start of the system.

[0013] This invention can be more fully understood from the following detailed description when taken in conjunction with the accompanying drawings, in which:

Fig. 1 is a block diagram showing an internal arrangement of an IC card according to an embodiment of the present invention;

Figs. 2A and 2B are flow charts for explaining processing flows for performing data communication with the IC card shown in Fig. 1;

Fig. 3 is a flow chart for explaining an operation of an external device shown in Fig. 1;

Fig. 4 is a flow chart for explaining a processing flow for updating initial data in the IC card shown in Fig. 1; and

Fig. 5 is a view showing a format of an initial data updating command.

[0014] An IC card according to an embodiment of the present invention will be described below with reference to the accompanying drawings.

[0015] An internal arrangement of IC card 1 according to this embodiment will be described with reference to Fig. 1. IC card 1 incorporates mask ROM 2 for storing control programs, data memory 3 constituted by an EEPROM and/or a battery backed-up RAM for storing various types of data, CPU 4 for performing various control operations on the basis of the contents of the control programs in mask ROM 2, contact portion 5 brought into electrical contact with external device 7 such as a reader/writer to perform data exchange with external device 7, and communication I/O circuit 6 for communicating with external device 7 with a predetermined communication protocol at a predetermined baud rate.

[0016] Two different protocols A and B for performing communication are stored in mask ROM 2. When IC card 1 is to communicate with external device 7, CPU 4 performs communication control in accordance with protocol A or B stored in mask ROM 2. RAM 40 is incorporated in CPU 4.

[0017] An operation for causing IC card 1 to perform data communication with external device (reader/writer) 7 will be described with reference to Figs. 2A to 5.

[0018] CPU 4 reads out data at address $0000 of data memory 3 to determine whether the upper nibble of this readout data is 0_H (step ST1) where "H" indicate hexadecimal notation. An asterisk of 0*H in step ST1 indicates a wildcard character which can be substituted with an arbitrary number.

[0019] If the upper nibble of address $0000 is 0_H, CPU 4 determines that IC card 1 supports only protocol A or B (to be referred to as case 1 hereinafter), and processing starting from step ST2 to be described later is performed.

[0020] If the upper nibble of the data at address $0000 of data memory 3 is a value except for 0_H, CPU 4 determines that IC card 1 supports two different protocols A and B and that protocol A or B can be designated by an external device (to be referred to as case 2 hereinafter). In this case, processing starting from step ST14 to be described later is performed.

[0021] Note that an address in step ST1 may be any value other than $0000 and may be exemplified by $FFFF. In this case, F*H is checked in step ST1, and *FH is checked in step ST2 or ST14.

[0022] Processing under the condition that IC card 1 supports either protocol A or B, i.e., case 1, will be described with reference to Fig. 2A. IC card 1 receives a power and a clock signal from external device 7 and is controlled by CPU 4.

[0023] Prior to data communication, a reset signal is supplied from external device 7 to CPU 4. When this reset signal is disabled, initial data called "Answer to Reset" (ANS-TO-RESET) is output from CPU 4 in IC card 1 to external device 7. The "Answer to Reset" information includes data defining the type of communication protocol supported by IC card 1. External device 7 receives "Answer to Reset" information and checks the communication protocol used with IC card 1 (cf. ISO/IEC DIS 7816-3).

[0024] Fig. 3 is a flow chart for explaining how external device 7 communicates with IC card 1.

[0025] When the "Answer to Reset" information is output from IC card 1 (steps ST3 and ST6 in Fig. 2A or steps ST15 and ST21 in Fig. 2B), external device 7 receives this "Answer to Reset" information (step ST201). A protocol used until the "Answer to Reset" information is output is standardized in accordance with ISO standards. This "Answer to Reset" information includes data representing the protocol supported by IC card 1.

[0026] External device (e.g., a bank terminal or a credit terminal) 7 supports one protocol. A CPU (not shown) in external device 7 checks (step ST202) on the basis of the input "Answer to Reset" information whether its own protocol is supported by IC card 1.

[0027] If the protocol of external device 7 is supported by IC card 1 (YES in step ST202), external device 7 outputs information for selecting its own protocol (step ST203) and then outputs various commands to IC card 1 (step ST204). If the protocol of external device 7 is not supported by IC card 1 (NO in step ST202), error information is output (step ST205).

[0028] That is, on the basis of protocol selection information from external device 7, IC card 1 sends "Answer to Reset" information including the data representing the protocol supported by this IC card 1. Therefore, one of the plurality of protocols supported by this IC card is selected by external device 7.

[0029] IC card 1 can correspond to different types of protocols supported by different types of external devices 7 in the arrangement of Fig. 1 and the processing operations of Figs. 2A and 2B. Each external device 7 automatically switches and selects one of the protocols from IC card 1 which supports multi-protocols.

[0030] Protocol switching is mainly assumed as switching between the IC card protocol and basic procedures of processing performed using an IC card. A semiduplex block transmission scheme is used as the IC card protocol.

[0031] Referring back to Fig. 2A, CPU 4 in IC card 1 reads out data at address $0000 of data memory 3 before CPU 4 outputs the "Answer to Reset" information to external device 7. After CPU 4 determines (step ST1) that the upper nibble of the data is 0H, CPU 4 determines (step ST2) whether the lower nibble of the data is 0_H.

[0032] If the lower nibble of address $0000 is set to be 0_H, CPU 4 outputs the "Answer to Reset" information representing that the "communication protocol is protocol A" (step ST3). In protocol A, control transits to a state for waiting a command from external device 7 (step ST4). The command waiting state is maintained in protocol A until any command input is entered (step

ST5).

[0033] If the lower nibble at address $0000 is any value other than 0_H in step ST2, CPU 4 outputs the "Answer to Reset" information representing that the "communication protocol is protocol B" (step ST6). CPU 4 is then set in an external command waiting state in protocol B (step ST7). In this case, CPU 4 continues the command waiting state in protocol B until any command input is entered (step ST8).

[0034] When CPU 4 receives a command (cf. step ST204 in Fig. 3) from external device 7, CPU 4 determines (step ST9) whether this command is a data communication end command. If this command is determined not to be a data communication end command, processing corresponding to the determined command is performed (step ST10). CPU 4 checks the value of address $0000 in data memory 3 to check if the lower nibble of the data is 0_H (step ST11).

[0035] If the lower nibble of address $0000 is 0_H in step ST11, a processing result is output to the external device in protocol A (ST12), and CPU 4 returns to the command waiting state in protocol A in step ST3 described above. If the lower nibble of address $0000 is a value other than 0_H in step ST11, a processing result is output to the external device in protocol B (step ST13). CPU 4 then returns to the command waiting state in protocol B in step ST6.

[0036] In step ST9, if the received command is the data communication end command, CPU 4 ends data communication processing.

[0037] Data communication processing of IC card 1 under the condition that IC card 1 supports two different communication protocols and one of them can be designated by the external device, i.e., case 2, will be described with reference to Fig. 2B.

[0038] IC card 1 receives external power and an external clock signal to set CPU 4 operative, as described above. After the reset signal is disabled, CPU 4 reads out data at address $0000 and determines (step ST1) whether the upper nibble of the data at address $0000 is any value other than 0_H. CPU 4 determines (step ST14) whether the lower nibble of the data is 0_H.

[0039] In this case, if the lower nibble of the data at address $0000 is 0_H, CPU 4 outputs "Answer to Reset" information representing protocol A as a protocol having the first priority (to be referred to as the first protocol hereinafter) and protocol B as a protocol having the second priority (to be referred to as the second protocol hereinafter) to external device 7 (step ST15). Data "00_H" is stored at a specific address of RAM 40 in CPU 4 (step ST16), and CPU 4 is set in protocol A in a state for receiving a command from the external device (step ST17).

[0040] When CPU 4 receives any data in the command waiting state in protocol A, CPU 4 determines (step ST18) whether the input data is PTS (Protocol Type Selection) data for selecting a communication protocol.

[0041] If the received data is the protocol type selection data (PTS data), CPU 4 determines (step ST19) whether the PTS data is data for designating protocol B. If so, data "01_H" is stored at a specific address of the RAM in CPU 4 (step ST22), and CPU 4 is set in a command waiting state with protocol B in step ST23 (to be described later).

[0042] If the received data is not PTS data in step ST18 or the PTS data is not the PTS data for designating protocol B in step ST19, CPU 4 determines (step ST20) whether the received data is a command. If NO in step ST20, CPU 4 is set in a command waiting state in protocol A (step ST17).

[0043] In step ST14, if the lower nibble of the data at address $0000 is a value other than 0_H, CPU 4 outputs to external device 7 "Answer to Reset" information representing protocol B as the first protocol and protocol A as the second protocol (step ST21), and data "01_H" is stored at a specific address of the RAN in CPU 4 (step ST22). CPU 4 is then set in an external command waiting state in protocol B (step ST23).

[0044] When CPU 4 receives any data in the command waiting state in protocol B, CPU 4 determines (step ST24) whether the data is protocol type selection data (PTS data). If the received data is determined to be PTS data, CPU 4 determines (step ST25) whether the PTS data is data for designating protocol A. If YES in step ST25, data "00_H" is stored at a specific address of RAM 40 in CPU 4 (step ST16). CPU 4 is set in the command waiting state in protocol A in step ST17 described above.

[0045] If the received data is not PTS data in step ST24 or the PTS data is not PTS data for designating protocol A in step ST25, CPU 4 determines (step ST26) whether the subsequently received data is a command. If NO in step ST26, CPU 4 is set in the command waiting state in protocol B again (step ST23).

[0046] When CPU 4 determines in steps ST20 and ST26 that the data received from external device 7 is a command, CPU 4 determines (step ST27) whether the command is a data communication end command. If NO in step ST27, processing of this command is performed (step ST28). The content of the specific address of RAM 40 incorporated in CPU 4 is checked (step ST29).

[0047] If the content of the specific address of RAM 40 is 00_H, a command processing result is output in protocol A (step ST30). CPU 4 is set in the command waiting state in protocol A in step ST17 described above. If the content of the specific address of RAN 40 is not 00_H, a command processing result is output in protocol B (step ST31). CPU 4 is then set in the command waiting state in protocol B in step ST23 described above.

[0048] If CPU 4 determines in step ST27 that the received command is a data communication end command, data communication processing is ended.

[0049] A communication baud rate (9,600 bps,

4,800 bps, or 1,200 bps) with external device 7 can be set simultaneously when a protocol is set in steps ST4, ST7, ST15, and ST21.

[0050] Hardware of a variable baud rate (multi-baud rate) can be performed by changing the frequency of a communication clock in I/O circuit 6.

[0051] When data communication is to be performed between IC card 1 and external device 7, CPU 4 in IC card 1 refers to the data content at address $0000 of data memory 3 as initial data (step ST1) and determines whether protocol A or B is used in data communication on the basis of the initial data. In order to change the communication protocol, the initial data (0*H) in memory 3 must be updated. This processing will be described with reference to Fig. 4.

[0052] In order to update the initial data, an initial data updating command having a format shown in Fig. 5 is sent from external device 7 to CPU 4 in IC card 1. This command consists of function code FC representing that a change is to be made in initial data, and data DA to be updated. When CPU 4 in IC card 1 receives this command, data DA is written at address $0000 of data memory 3 (step ST101) and checks (step ST102) whether the data is properly written. If YES in step ST102, a response indicating OK is generated (step ST103). Otherwise, a response indicating a write error is generated (step ST104).

[0053] The generated response is output to external device 7 in accordance with processing result output processing (step ST12 or ST13 in case 1 and step ST30 or ST31 in case 2). By using this command, for example, the communication protocol (A or B) supported by IC card 1 can be changed from external device 7 even in case 1.

[0054] As described above, IC card 1 of this embodiment can change the communication protocol from the side of external device 7 in accordance with the specifications of external device 7 which performs data communication. Accurate data communication can be performed with external devices 7 having different types of communication protocol. Therefore, versatility of the IC card can be improved, and a system using an IC card can be flexibly arranged.

[0055] Selection or switching of a baud rate and/or a communication protocol can be performed by external device 7. Even if a plurality of terminals having different communication protocols and baud rates are connected to each other and data is exchanged therebetween, accurate data communication can be performed by switching to a proper communication protocol and a proper baud rate.

[0056] Assuming that a plurality of communication protocols can be supported (NO in steps ST1 in Fig. 2A; Fig. 2B), a priority order is given to these plurality of protocols (A and B) and a communication protocol (e.g., A) having a higher priority can be selected by default. For example, if communication protocol A which is more frequently used has a higher priority (i.e., protocol A has a higher priority if $0000 = *0H in step ST4 of Fig. 2B), data communication can be automatically performed in communication protocol A, which is more frequently used, at the start time of the system.

[0057] IC card 1 of this embodiment may support a plurality of protocols (A and B) or only one communication protocol (either A or B). Even if IC card 1 is set to support only one communication protocol (YES in step ST1 of Fig. 2A), the type of communication protocol (A or B) can be changed by the procedures in Fig. 4. An IC card which is used for only one terminal can be set to support only one communication protocol (e.g., only protocol A) for this terminal.

[0058] In addition, various setup operations and changes can be very easily performed by only updating the content of address $0000 of data memory 3 from external device 7 in accordance with the procedures in Fig. 3.

[0059] The number of types of communication protocols supported by an IC card is not limited to two. An IC card can have three or more communication protocols, and these protocols can be appropriately selected and used.

[0060] The portable electronic apparatus of the present invention, as has been described above, can automatically select a communication protocol (A) having the highest priority at the start time of the IC card under the condition that a priority order (A > B) is set for a plurality of communication protocols stored in storing means (2). For this reason, when data communication is performed using the communication protocol (A) having the highest priority, data communication can be started simultaneously when the system is started.

Claims

1. A portable electronic device connectable to an external device, comprising:

   means for communicating with the external device by means of a predetermined protocol; and

   first storing means (2) for storing software programs;

   wherein

   said first storing means (2) stores software programs respectively using different communication protocols (A, B);

   and in that said portable electronic device includes:

   second storing means (3) for storing prescribed information serving to discriminate a specific protocol (A, B) which is to be used by the portable electronic device (1) for a communication with the external device (7), each protocol having a priority order associated therewith;

   means (4) for discriminating the specific proto-

col (A, B) which has a higher priority order from the programs stored in said first storing means (2) in accordance with the prescribed information stored in said second storing means (3);

means (5, 6) for supplying the external device (7) with data (ANS-TO-RESET data at ST3, ST6, ST15, ST21) indicating the protocols supported by said portable electronic device (1) and priority order information;

third storing means (40) for storing data related to said specific protocol which is to be used when communication is started with said external device in accordance with the discriminating result;

communication means (5, 6) for communicating with said external device based on one of said software programs stored in said first storing means, said one software program corresponding to said specific protocol which the data stored in said third storing means are related to;

means (4) for receiving from said external device (7) protocol-type selection information indicating the specific protocol to be used for the communication; and

means (ST16, ST22) for changing said specific protocol used by said portable electronic device during communication in response to a protocol type selection information input from said external device, where said specific protocol is changed by modifying the stored contents of said third storing means.

2. A portable electronic device according to claim 1, characterized by further comprising:

means (4) for updating the prescribed information stored in said second storing means (3) in accordance with a command (Fig. 5) delivered from the external device (7).

3. A portable electronic device according to claim 1, characterized in that said second storing means (3) includes:

a first area for storing first prescribed information used to determine (ST1) whether only one protocol is employed for said specific protocol (A, B); and

a second area for storing second prescribed information used to check (ST2) a content of the one protocol (A, B) when only one protocol is employed for said specific protocol (A, B).

4. A portable electronic device according to claim 3, characterized in that said discriminating means (4) includes means (ST1, ST2, ST14) for determining whether only one protocol is to be employed for said specific protocol (A, B) in accordance with the prescribed information stored in said second storing means (3), to thereby provide a determining result (Y/N at ST1, ST2, ST14); and

said supplying means (5, 6) includes means (6) for sending data representing said different communication protocols (A, B) which are to be used for the communication, in accordance with the determining result (YES/NO at ST1, ST2, St14) provided by said determining means (ST1, ST2, ST14).

5. A portable electronic device according to claim 4, characterized in that said second storing means (3) includes:

a third area for storing priority order information with respect to a priority of each of said different communication protocols (A, B); and

said supplying means (5, 6) includes means (6; ST15, ST21) for sending said priority order information as well as said different communication protocols (A, B) to be used for the communication, in accordance with the determining result (YES/NO at ST1, ST2, ST14) provided by said determining means (ST1, ST2, ST14).

6. An IC card system comprising an IC card (1) and an external device (7), the IC card (1) being connectable to said external device (7);

said IC card comprising means for communicating with said external device (7) by means of a predetermined protocol, and first storing means (2) for storing software programs;

wherein

said first storing means (2) stores a plurality of programs respectively using different communication protocols (A and B);

said IC card (1) includes: second storing means (3) for storing prescribed information serving to discriminate a specific protocol (A, B) stored in said first storing means (2), which is to be used by said IC card (1) for a communication with said external device (7), each protocol having a priority order associated therewith;

means (4) for discriminating the specific protocol (A, B) which has a higher priority order from the programs stored in said first storing means (2) in accordance with the prescribed information stored in said second storing means (3);

means (5, 6) for supplying to the external device (7) data (ANS-TO-RESET data at ST3, ST6, ST15, ST21) indicating the protocols supported by said IC card (1) and priority order information;

third storing means (40) for storing data related

to said specific protocol which is to be used when communication is started with said external device in accordance with the discriminating result;

communication means (5, 6) for communicating with said external device based on one of said software programs stored in said first storing means, said one software program corresponding to said specific protocol which the data stored in said third storing means are related to;

means (4) for receiving from said external device (7) protocol-type selection information indicating the specific protocol to be used for the communication; and

means (ST16, ST22) for changing said specific protocol used by said portable electronic device during communication in response to a protocol type selection information input from said external device, where said specific protocol is changed by modifying the stored contents of said third storing means, and that said external device (7) includes:

means (ST203) for selecting one of the communication protocols (A, B) in accordance with the data indicating the supported protocols (ANS-TO-RESET data) supplied by said supplying means (5, 6), to thereby provide a result of selecting; and

means (ST204) for sending the result provided by said selecting means (ST203) to said IC card (1), so that said external device (7) communicates with said IC card (1) using the one communication protocol (A or B) selected by said selecting means (ST203).

Patentansprüche

1. Tragbare elektronische Vorrichtung, die mit einem externen Gerät verbindbar ist, mit

einem Mittel zum Kommunizieren mit dem externen Gerät mittels eines vorbestimmten Protokolls, und

einem ersten Speichermittel (2) zum Speichern von Softwareprogrammen, bei der

das erste Speichermittel (2) Softwareprogramme speichert, die jeweils unterschiedliche Kommunikationsprotokolle (A, B) benutzen, und

die tragbare elektronische Vorrichtung

ein zweites Speichermittel (3) zum Speichern von vorgeschriebener Information, die zur Unterscheidung eines spezifischen Protokolls (A, B) dient, das durch die tragbare elektronische Vorrichtung (1) für eine Kommunikation mit dem externen Gerät (7) zu benutzen ist, wobei jedes Protokoll eine diesem zugeordnete Priorität aufweist,

ein Mittel (4) zum Unterscheiden des spezifischen Protokolls (A, B), das einen höheren Prioritätsrang aufweist, aus den Programmen, die in dem ersten Speichermittel (2) gespeichert sind, in Übereinstimmung mit der vorgeschriebenen Information, die in dem zweiten Speichermittel (3) gespeichert ist,

ein Mittel (5, 6) zum Beliefern des externen Geräts (7) mit Daten (ANS-TO-RESET-Daten bei ST3, ST6, ST15, ST21), die die Protokolle, die durch die tragbare elektronische Vorrichtung (1) unterstützt werden, und die Prioritätsreihenfolge angeben,

ein drittes Speichermittel (40) zum Speichern von Daten, die sich auf das spezifische Protokoll, das in Übereinstimmung mit dem Unterscheidungsergebnis zu verwenden ist, wein die Kommunikation mit dem externen Gerät gestartet wird, beziehen,

einem Kommunikationsmittel (5, 6) zum Kommunizieren mit dem externen Gerät basierend auf einem der Softwareprogramme, die in dem ersten Speichermittel gespeichert sind, wobei das eine Softwareprogramm dem spezifischen Protokoll entspricht, auf das sich die Daten, die in dem dritten Speichermittel gespeichert sind, beziehen,

ein Mittel (4) zum Empfangen von Protokolltypauswahlinformation, die das spezifische Protokoll anzeigt, das für die Kommunikation zu verwenden ist, von dem externen Gerät (7), und

ein Mittel (ST16, ST22) zum Ändern des spezifischen Protokolls, das durch die tragbare elektronische Vorrichtung verwendet wird, während einer Kommunikation als Reaktion auf eine Protokolltypauswahlinformation, die von dem externen Gerät eingegeben wird, wobei das spezifische Protokoll geändert wird durch Modifizieren der gespeicherten Inhalte des dritten Speichermittels,

aufweist.

2. Tragbare elektronische Vorrichtung nach Anspruch 1, dadurch **gekennzeichnet,** dass sie weiter

ein Mittel (4) zum Aktualisieren der vorgeschriebenen Information, die in dem zweiten Speichermittel (3) gespeichert ist, in Übereinstimmung mit einem Befehl (Fig. 5), der von dem externen Gerät (7) geliefert wird, aufweist.

3. Tragbare elektronische Vorrichtung nach Anspruch 1, dadurch **gekennzeichnet,** dass das zweite Speichermittel (3)

einen ersten Bereich zum Speichern einer

ersten vorgeschriebenen Information, die verwendet wird zum Bestimmen (ST1), ob nur ein Protokoll für das spezifische Protokoll (A, B) verwendet wird, und

einen zweiten Bereich zum Speichern einer zweiten vorgeschriebenen Information, die verwendet wird zum Überprüfen (ST2) eines Inhalts des einen Protokolls (A, B), wenn nur ein Protokoll für das spezifische Protokoll (A, B) verwendet wird, aufweist.

4. Tragbare elektronische Vorrichtung nach Anspruch 3, dadurch **gekennzeichnet,**

dass das Unterscheidungsmittel (4) ein Mittel (ST1, ST2, ST14) zum Bestimmen, ob nur ein Protokoll für das spezifische Protokoll (A, B) zu verwenden ist, in Übereinstimmung mit der vorgeschriebenen Information, die in dem zweiten Speichermittel (3) gespeichert ist, um dadurch ein Bestimmungsergebnis (Y/N bei ST1, ST2, ST14) bereitzustellen, aufweist, und
dass das Belieferungsmittel (5, 6) ein Mittel (6) zum Senden von Daten, die die unterschiedlichen Kommunikationsprotokolle (A, B), die für die Kommunikation in Übereinstimmung mit dem Bestimmungsergebnis (JA/NEIN bei ST1, ST2, ST14), das durch das Bestimmungsmittel (ST1, ST2, ST14) bereitgestellt wird, zu verwenden sind, repräsentieren, aufweist.

5. Tragbare elektronische Vorrichtung nach Anspruch 4, dadurch **gekennzeichnet,**

dass das zweite Speichermittel einen dritten Bereich zum Speichern von Prioritätsreihenfolgeninformation einer Priorität jedes der unterschiedlichen Kommunikationsprotokolle (A, B) aufweist, und
dass das Belieferungsmittel (5, 6) ein Mittel (6; ST15, ST21) zum Senden der Prioritätsreihenfolgeninformation sowie der unterschiedlichen Kommunikationsprotokolle (A, B), die für die Kommunikation zu verwenden sind, in Übereinstimmung mit dem Bestimmungsergebnis (JA/NEIN bei ST1, ST2, ST14), das durch das Bestimmungsmittel (ST1, ST2, ST14) bereitgestellt wird, aufweist.

6. IC-Kartensystem, das eine IC-Karte (1) und ein externes Gerät (7) aufweist, wobei die IC-Karte (1) mit dem externen Gerät (7) verbindbar ist.
wobei die IC-Karte ein Mittel zum Kommunizieren mit dem externen Gerät (7) mittels eines vorbestimmten Protokolls und ein erstes Speichermittel (2) zum Speichern von Softwareprogrammen aufweist,
beim dem
das erste Speichermittel (2) eine Mehrzahl von Programmen speichert, die jeweils unterschiedliche Kommunikationsprotokolle (A und B) benutzen,
die IC-Karte (1)
ein zweites Speichermittel (3) zum Speichern von vorgeschriebener Information, die zum Unterscheiden eines spezifischen Protokolls (A, B) dient, das in dem ersten Speichermittel (2) gespeichert ist, das von der IC-Karte (1) für eine Kommunikation mit dem externen Gerät (7) zu verwenden ist, wobei jedes Protokoll eine diesem zugeordnete Priorität aufweist,
ein Mittel (4) zum Unterscheiden des spezifischen Protokolls (A, B), das einen höheren Prioritätsrang aufweist, aus den Programmen, die in dem ersten Speichermittel (2) gespeichert sind, in Übereinstimmung mit der vorgeschriebenen Information, die in dem zweiten Speichermittel (3) gespeichert ist,
ein Mittel (5, 6) zum Liefern von Daten (ANS-TO-RESET bei ST3, ST5, ST15, ST21) an das externe Gerät (7), die die Protokolle, die durch die IC-Karte (1) unterstützt werden, und die Prioritätsreihenfolgeninformation angeben,
ein drittes Speichermittel (40) zum Speichern von Daten, die sich auf das spezifische Protokoll, das in Übereinstimmung mit dem Unterscheidungsergebnis zu verwenden ist, wenn die Kommunikation mit der externen Vorrichtung gestartet wird, beziehen,
ein Kommunikationsmittel (5, 6) zum Kommunizieren mit dem externen Gerät basierend auf einem der Softwareprogramme, die in dem ersten Speichermittel gespeichert sind, wobei das eine Softwareprogramm dem spezifischen Protokoll entspricht, auf das sich die Daten, die in dem dritten Speichermittel gespeichert sind, beziehen,
ein Mittel (4) zum Empfangen einer Protokolltypauswahlinformation, die das spezifische Protokoll, das für die Kommunikation zu verwenden ist, anzeigt, von dem externen Gerät (7), und
ein Mittel (ST16, ST22) zum Ändern des spezifischen Protokolls, das durch die tragbare elektronische Vorrichtung zu verwenden ist, während der Kommunikation als Reaktion auf eine Protokolltypauswahlinformation, die von dem externen Gerät eingegeben wird, wobei das spezifische Protokoll durch Modifizieren der gespeicherten Inhalte des dritten Speichermittels geändert wird, aufweist, und
das externe Gerät (7)
ein Mittel (ST203) zum Auswählen von einem der Kommunikationsprotokolle (A, B) in Übereinstimmung mit den Daten (ANS-TO-RESET-

Daten), die die unterstützten Protokolle anzeigen, die durch das Liefermittel (5, 6) geliefert werden, um dadurch ein Ergebnis der Auswahl bereitzustellen, und

ein Mittel (ST204) zum Senden des Ergebnisses, das durch das Auswahlmittel (ST203) bereitgestellt wird, an die IC-Karte (1), so dass das externe Gerät (7) mit der IC-Karte (1) unter Verwendung des einen Kommunikationsprotokolls (A oder B), das durch das Auswahlmittel (ST203) ausgewählt worden ist, kommuniziert, aufweist.

Revendications

1. Dispositif électronique portatif pouvant être relié à un dispositif extérieur, comportant :

des moyens pour communiquer avec le dispositif extérieur à l'aide d'un protocole prédéterminé ; et
des premiers moyens de mémoire (2) pour mémoriser des programmes logiciels;
dans lequel :
lesdits premiers moyens de mémoire (2) mémorisent des programmes logiciels en utilisant respectivement différents protocoles de communication (A, B) ;
et ledit dispositif électronique portatif comprend :
des seconds moyens de mémoire (3) pour mémoriser une information prescrite servant à discriminer un protocole spécifique (A, B) qui doit être utilisé par le dispositif électronique portatif (1) pour une communication avec le dispositif extérieur (7), à chaque protocole étant associé un ordre de priorité ;
des moyens (4) pour discriminer le protocole spécifique (A, B) qui présente un ordre de priorité plus élevé parmi les programmes mémorisés dans lesdits premiers moyens de mémoire (2) conformément à l'information prescrite mémorisée dans lesdits seconds moyens de mémoire (3) ;
des moyens (5, 6) pour délivrer au dispositif extérieur (7) des données (données Réponse-à-Restauration en ST3, ST6, ST15, ST21) indiquant les protocoles supportés par ledit dispositif électronique portatif (1) et une information concernant l'ordre de priorité ;
des troisièmes moyens de mémoire (40) pour mémoriser des données en relation avec ledit protocole spécifique que l'on doit utiliser lorsque l'on démarre la communication avec ledit dispositif extérieur en accord avec le résultat de discrimination ;
des moyens de communication (5, 6) pour communiquer avec ledit dispositif extérieur en se basant sur l'un desdits programmes logiciels mémorisés dans lesdits premiers moyens de mémoire, ledit programme logiciel en question correspondant audit protocole spécifique avec lequel les données mémorisées dans lesdits troisièmes moyens de mémoire sont en relation ;
des moyens (4) pour recevoir dudit dispositif extérieur (7) une information de sélection de type de protocole indiquant le protocole spécifique à utiliser pour la communication ; et
des moyens (ST16, ST22) pour changer ledit protocole spécifique utilisé par ledit dispositif électronique portable pendant la communication en réponse à une information de sélection de type de protocole entrée depuis ledit dispositif extérieur, lorsque ledit protocole spécifique est changé en modifiant le contenu mémorisé desdits troisièmes moyens de mémoire.

2. Dispositif électronique portatif selon la revendication 1, caractérisé en ce qu'il comporte en outre :

des moyens (4) de mise à jour de l'information prescrite (O*H, *OH) mémorisée dans lesdits seconds moyens de mémoire (3) conformément à une commande (Figure 5) délivrée par le dispositif extérieur (7).

3. Dispositif électronique portatif selon la revendication 1, caractérisé en ce que lesdits seconds moyens de mémoire (3) comprennent :

une première zone pour mémoriser la première information prescrite (O*H) utilisée pour déterminer (ST1) si seulement un protocole est utilisé pour ledit protocole particulier (A, B) ; et une seconde zone pour mémoriser une seconde information prescrite (*OH) utilisée pour vérifier (ST2) le contenu du protocole (A, B) lorsque seulement un protocole est utilisé pour ledit protocole particulier (A, B).

4. Dispositif électronique portatif selon la revendication 3 caractérisé en ce que lesdits moyens de discrimination (4) comprennent des moyens (ST1, ST2, ST14) pour déterminer si seulement un protocole doit être utilisé pour ledit protocole particulier (A, B) conformément à l'information prescrite (O*H) mémorisée dans lesdits seconds moyens de mémoire (3), pour ainsi délivrer un résultat de détermination (OUI/NON en ST1, ST2, ST14) ; et

lesdits moyens de délivrance (5, 6) comprennent des moyens (6) pour émettre des données représentant lesdits protocoles de communication différents (A, B) utilisés pour la communication, selon le résultat prédéterminé

(OUI/NON en ST1, ST2, ST14) délivré par lesdits moyens de détermination (ST1, ST2, ST14).

5. Dispositif électonique portatif selon la revendication 4, caractérisé en ce que lesdits seconds moyens de mémoire (3) comprennent :

une toisième zone pour mémoriser une information d'ordre de priorité par rapport à une priorité de chacun desdits protocoles de communication différents (A, B) ; et
lesdits moyens de délivrance (5, 6) comprennent des moyens (6 ; ST15 ; ST21) pour émettre ladite information d'ordre de priorité ainsi que lesdits protocoles de communication différents (A, B) à utiliser pour la communication, selon le résultat prédéterminé (OUI/NON en ST1, ST2, ST14) délivré par lesdits moyens de détermination (ST1, ST2, ST14).

6. Système à carte à circuit intégré comportant une carte à circuit intégré (1) et un dispositif extérieur (7), la carte à circuit intégré (1) pouvant être reliée audit dispositif extérieur (7) ;

ladite carte à circuit intégré comportant des moyens pour communiquer avec ledit dispositif extérieur (7) à l'aide d'un protocole prédéterminé, et des premiers moyens de mémoire (2) pour mémoriser des programmes logiciels ;
dans lequel :
lesdits premiers moyens de mémoire (2) mémorisent une pluralité de programmes en utilisant respectivement différents protocoles de communication (A et B) ;
ladite carte à circuit intégré (1) comprend :
des seconds moyens de mémoire (3) pour mémoriser l'information prescrite servant à discriminer un protocole spécifique (A, B) mémorisé dans lesdits premiers moyens de mémoire (2), qui doit être utilisé par ladite carte à circuit intégré (1) pour une communication avec ledit dispositif extérieur (7) ; à chaque protocole étant associé un ordre de priorité ;
des moyens (4) pour discriminer le protocole spécifique (A, B) qui présente un ordre de priorité plus élevé parmi les programmes mémorisés dans lesdits premiers moyens de mémoire (2) conformément à l'information prescrite mémorisée dans lesdits seconds moyens de mémoire (3) ;
des moyens (5, 6) pour délivrer au dispositif extérieur (7) des données (données Réponse-à-Restauration en ST3, ST6, ST15, ST21) indiquant les protocoles supportés par ladite carte à circuit intégré (1) et une information concernant l'ordre de priorité ;
des troisièmes moyens de mémoire (40) pour mémoriser des données en relation avec ledit protocole spécifique que l'on doit utiliser lorsque l'on démarre la communication avec ledit dispositif extérieur en accord avec le résultat de discrimination ; des moyens de communication (5, 6) pour communiquer avec ledit
dispositif extérieur en se basant sur l'un desdits programmes logiciels mémorisés dans lesdits premiers moyens de mémoire, ledit programme logiciel en question correspondant audit protocole spécifique avec lequel les données mémorisées dans lesdits troisièmes moyens de mémoire sont en relation ;
des moyens (4) pour recevoir dudit dispositif extérieur (7) une information indiquant le protocole particulier à utiliser pour la communication ;
des moyens (ST16, ST22) pour changer ledit protocole spécifique utilisé par ledit dispositif électronique portable pendant la communication en réponse à une information de sélection de type de protocole entrée depuis ledit dispositif extérieur, lorsque ledit protocole spécifique est changé en modifiant le contenu mémorisé desdits troisièmes moyens de mémoire ; et
ledit dispositif extérieur (7) comprend
des moyens (ST203) pour sélectionner l'un des protocoles de communication (A, B) conformément aux données indiquant les protocoles supportés par ladite carte (données Réponse-à-Restauration) délivrées par lesdits moyens de délivrance (5, 6), pour ainsi délivrer un résultat de sélection ; et
des moyens (ST204) pour envoyer le résultat délivré par lesdits moyens de sélection (ST203) à ladite carte à circuit intégré (1), de sorte que ledit dispositif extérieur (7) communique avec ladite carte à circuit intégré (1) utilisant le protocole de communication (A ou B) choisi par lesdits moyens de sélection (ST203).

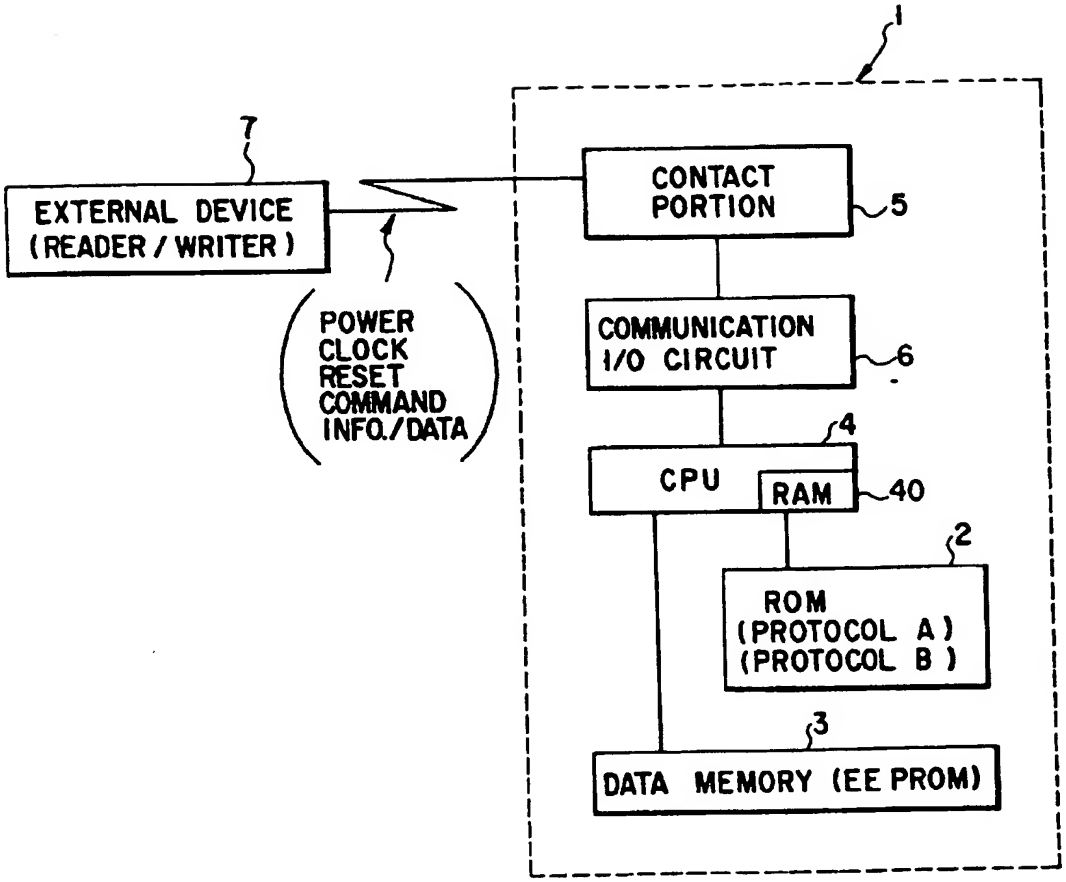
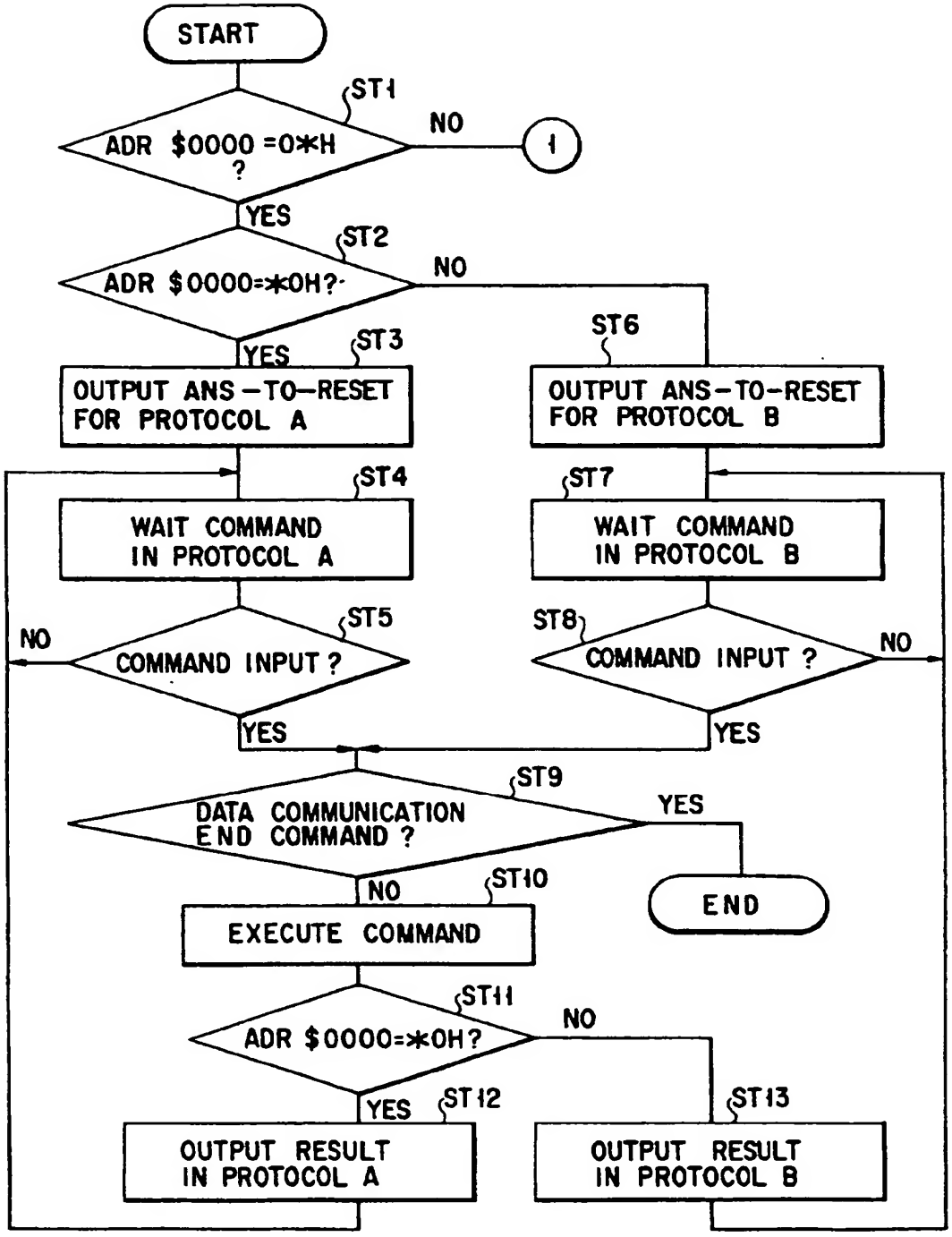

1
7
EXTERNAL DEVICE
(READER / WRITER)
POWER
CLOCK
RESET
COMMAND
INFO./DATA
CONTACT
PORTION
5
COMMUNICATION
I/O CIRCUIT
6
4
CPU
RAM
40
2
ROM
(PROTOCOL A)
(PROTOCOL B)
3
DATA MEMORY (EE PROM)

FIG. 1


START
ST1
ADR $0000 =0*H ?
NO
1
YES
ST2
ADR $0000=*0H?
NO
YES
ST3
OUTPUT ANS-TO-RESET FOR PROTOCOL A
ST6
OUTPUT ANS-TO-RESET FOR PROTOCOL B
ST4
WAIT COMMAND IN PROTOCOL A
ST7
WAIT COMMAND IN PROTOCOL B
ST5
NO
COMMAND INPUT ?
ST8
COMMAND INPUT ?
NO
YES
YES
ST9
DATA COMMUNICATION END COMMAND ?
YES
NO
ST10
EXECUTE COMMAND
END
ST11
ADR $0000=*0H?
NO
YES
ST12
OUTPUT RESULT IN PROTOCOL A
ST13
OUTPUT RESULT IN PROTOCOL B

F I G. 2A

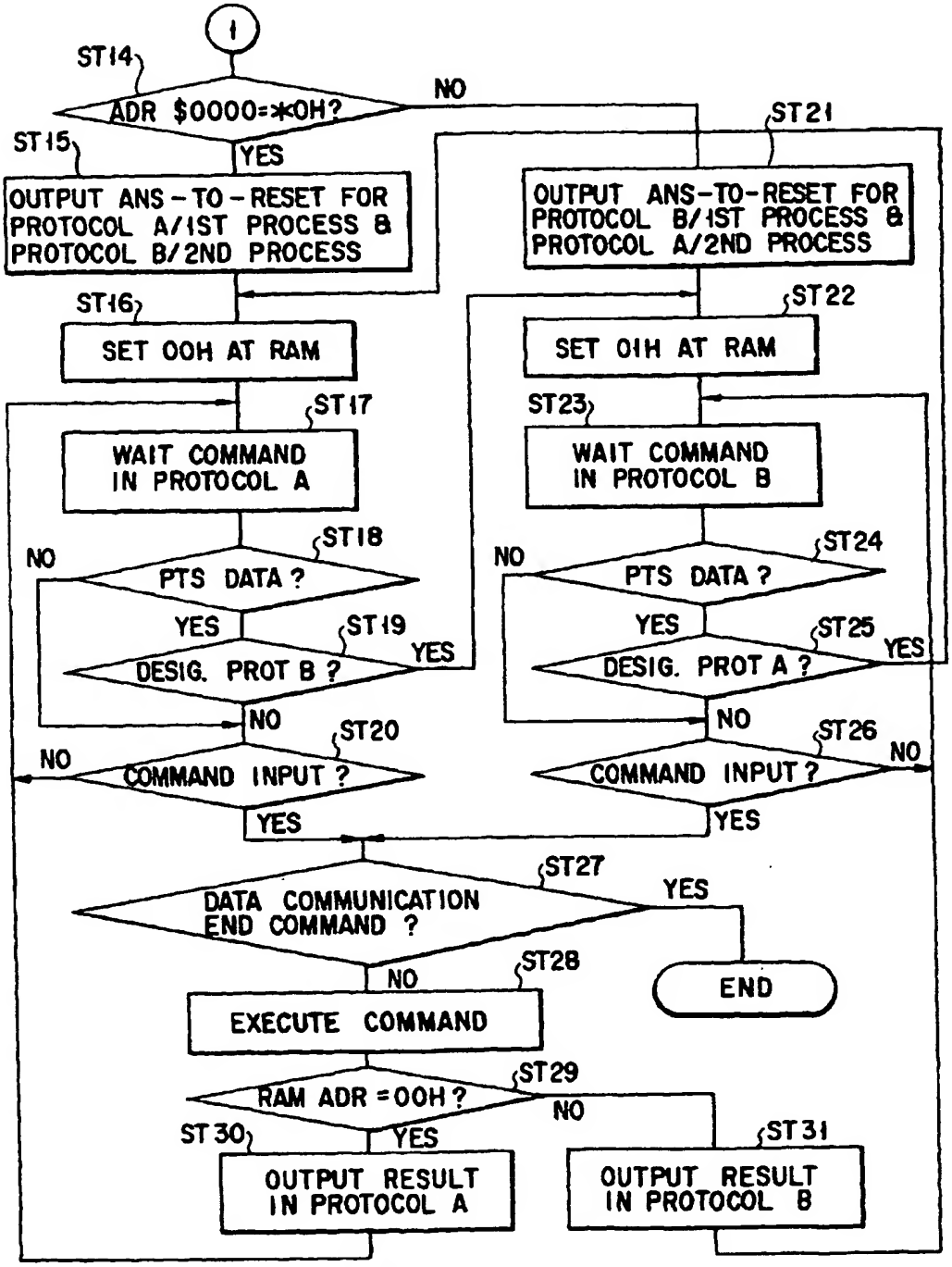

1
ST14
ADR $0000=*OH?
NO
YES
ST15
OUTPUT ANS-TO-RESET FOR PROTOCOL A/1ST PROCESS & PROTOCOL B/2ND PROCESS
ST21
OUTPUT ANS-TO-RESET FOR PROTOCOL B/1ST PROCESS & PROTOCOL A/2ND PROCESS
ST16
SET 00H AT RAM
ST22
SET 01H AT RAM
ST17
WAIT COMMAND IN PROTOCOL A
ST23
WAIT COMMAND IN PROTOCOL B
ST18
PTS DATA ?
NO
YES
ST24
PTS DATA ?
NO
YES
ST19
DESIG. PROT B ?
YES
NO
ST25
DESIG. PROT A ?
YES
NO
ST20
COMMAND INPUT ?
NO
YES
ST26
COMMAND INPUT ?
NO
YES
ST27
DATA COMMUNICATION END COMMAND ?
YES
NO
END
ST28
EXECUTE COMMAND
ST29
RAM ADR = 00H ?
NO
YES
ST30
OUTPUT RESULT IN PROTOCOL A
ST31
OUTPUT RESULT IN PROTOCOL B

FIG. 2B

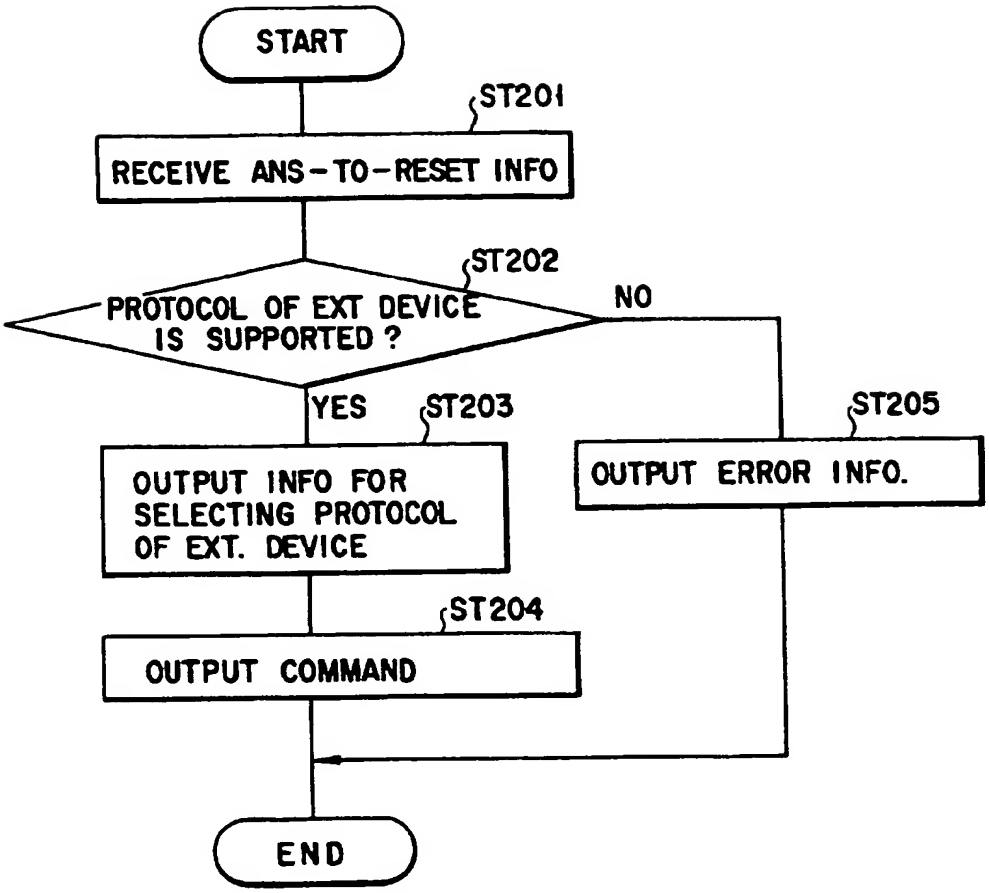

START
ST201
RECEIVE ANS-TO-RESET INFO
ST202
PROTOCOL OF EXT DEVICE IS SUPPORTED ?
NO
YES
ST203
OUTPUT INFO FOR SELECTING PROTOCOL OF EXT. DEVICE
ST205
OUTPUT ERROR INFO.
ST204
OUTPUT COMMAND
END

FIG. 3

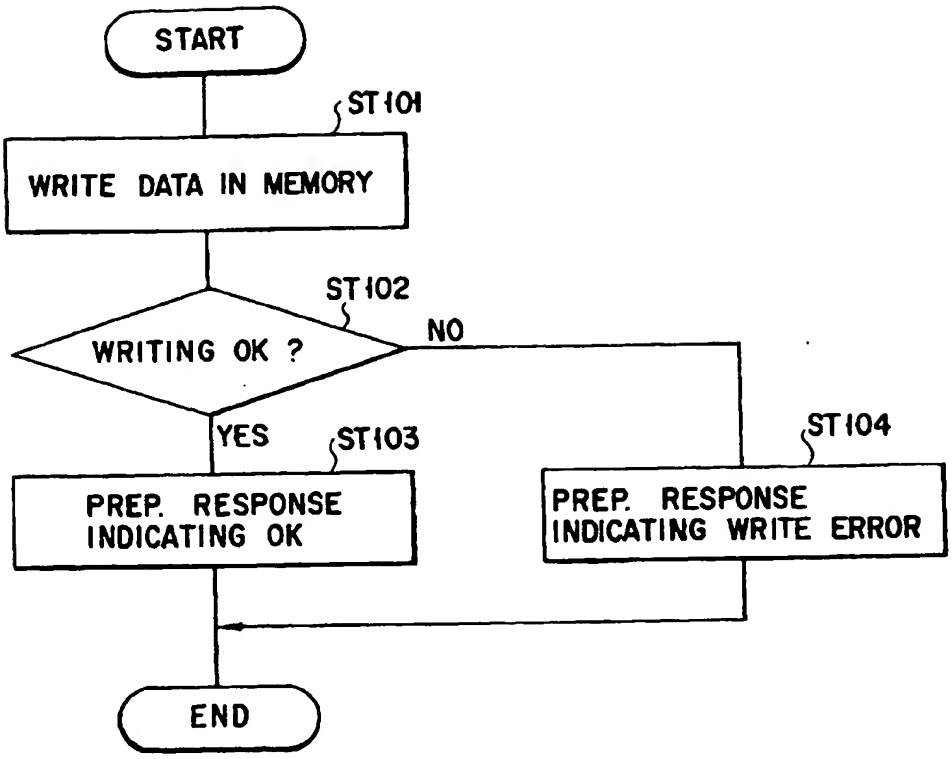

START
ST101
WRITE DATA IN MEMORY
ST102
WRITING OK ?
NO
YES
ST103
PREP. RESPONSE INDICATING OK
ST104
PREP. RESPONSE INDICATING WRITE ERROR
END

FIG. 4

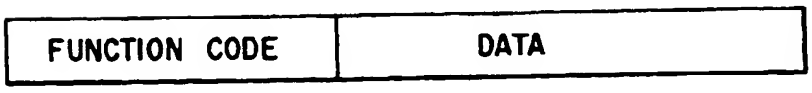

FUNCTION CODE
DATA

FIG. 5

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